Name :- Dheeraj soni
Section :- CE
Roll No. :- 23

Tutorial - 06

Ques 1

Minimum spanning tree :- It is a tree subset of edges of a connected edge-weighted undirected graph that connects all the vertices together without any cycles and with minimum possible edge weighted.

APPLICATION :-

1) Consider n stations are to be linked using a communication network and lying of link between any two stations involves a cost. The ideal solutions would be to extract a subgraph tremed as minimum cost spanning tree.

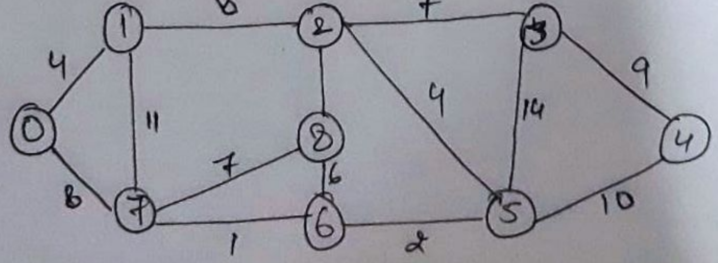
2) Designing LAN.

3) Laying pipeline connecting offshore drilling sites, refineries and consumer markets.

Ques 2

Algorithms	Time complexity	Space complexity
1) Prim's Algorithm	$O(\lvert E\rvert \log \lvert V\rvert)$	$O(\lvert V\rvert)$
2) Kruskal Algorithm	$O(\lvert E\rvert \log \lvert E\rvert)$	$O(\lvert V\rvert)$
3) Dijkstra Algorithm	$O(V^2)$	$O(V^2)$
4) Bell-mon ford	$O(VE)$	$O(E)$

Ques 3

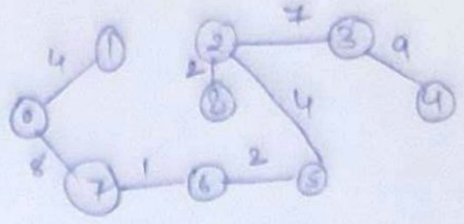


Prim's Algorithm :-

$$\text{weight} = 4+8+2+4+2+7+9+3$$
$$= \underline{37}$$

Kruskal's Algorithm :-

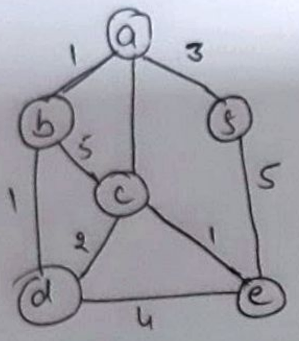
U	V	W	
6	7	1	✓
5	6	2	✓
2	8	2	✓
0	1	4	✓
2	5	4	✓
6	8	6	✗
2	3	7	✓
7	8	7	✗
0	7	8	✓
1	2	8	✗
4	3	9	✓
4	5	10	✗
1	7	11	✗
3	5	14	✗



weight = 1+2+2+4+4+7 +6+9

= $\underline{\underline{37}}$

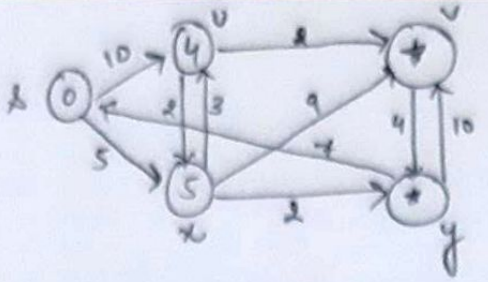
Ques 4)



1) The shortest path may change. The reason is that there may be different no. of edges in different paths from 's' to 't'. for eg- let the shortest path of weight is and has edges. Let there we another path with 2 edges & total weights. The weight of shortest path is increased by 5×10 and becomes 15+50 weight of other path is increased by 2×10 & becomes 26+20 so the shortest path changes to other part with weight as 45.

2) If we multiply all the edges weight by 10, the shortest path cannot change. The reason is that weights of all path from 's' to 't' gets multiplied by some unit. The no. of edges or path doesn't matter.

Ques 5



→ Dijkstra's Algorithm :-

Node	shortest Distance from source Node
u	8
x	5
v	9
y	7

→ Bellman Ford Algorithm :-

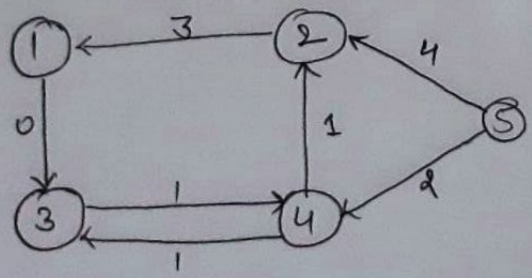
1st → s^{0} $u^{10\ \cancel{\infty}}$ v^{∞} $x^{\cancel{\infty}\ 5}$ y^{∞}

2nd → s^{0} u^{10} $v^{\cancel{\infty}\ 1}$ $x^{\cancel{\infty}\ 5}$ $y^{\cancel{\infty}}$

3rd → s^{0} $u^{\cancel{10}\ 8}$ $v^{\cancel{\infty}\ 9}$ x^{5} $y^{\cancel{\infty}\ 7}$

4th → s^{0} u^{8} v^{9} x^{5} y^{7}

Ques 6



$$
\begin{array}{c|ccccc}
 & 1 & 2 & 3 & 4 & 5 \\
\hline
1 & 0 & \infty & 6 & 3 & \infty \\
2 & 2 & 0 & \infty & \infty & \infty \\
3 & \infty & \infty & 0 & 2 & \infty \\
4 & \infty & 1 & 1 & 0 & \infty \\
5 & \infty & 4 & \infty & 2 & 0
\end{array}
$$

$$
\begin{array}{cc}
 & \begin{matrix} 1 & 2 & 3 & 4 & 5 \end{matrix} \\
\begin{matrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{matrix} & \begin{bmatrix} 0 & \infty & 6 & 3 & \infty \\ 2 & 0 & 8 & 5 & \infty \\ \infty & \infty & 0 & 2 & \infty \\ \infty & 1 & 1 & 0 & \infty \\ \infty & 4 & \infty & 2 & 0 \end{bmatrix}
\end{array}
$$

$$
\begin{array}{cc}
 & \begin{matrix} 1 & 2 & 3 & 4 & 5 \end{matrix} \\
\begin{matrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{matrix} & \begin{bmatrix} 0 & \infty & 6 & 3 & \infty \\ 2 & 0 & 8 & 5 & \infty \\ \infty & \infty & 0 & 2 & \infty \\ 3 & 1 & 1 & 0 & \infty \\ 6 & 4 & 12 & 2 & 0 \end{bmatrix}
\end{array}
$$

$$
\begin{array}{cc}
 & \begin{matrix} 1 & 2 & 3 & 4 & 5 \end{matrix} \\
\begin{matrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{matrix} & \begin{bmatrix} 0 & \infty & 6 & 3 & \infty \\ 2 & 0 & 8 & 5 & \infty \\ \infty & \infty & 0 & 2 & \infty \\ 3 & 1 & 1 & 0 & \infty \\ 6 & 4 & 12 & 2 & 0 \end{bmatrix}
\end{array}
$$

$$
\left.\begin{array}{l} T.C. \longrightarrow O(|V|^3) \\ S.C. \longrightarrow O(|V|^2) \end{array}\right\}
$$